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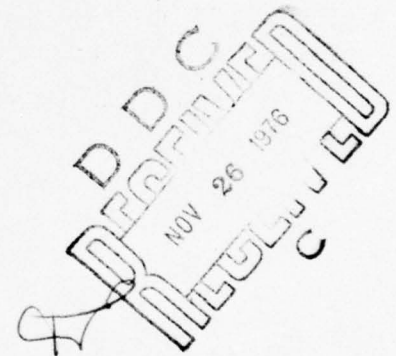
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TECHNICAL REPORT

ABSTRACTS OF RESEARCH PROJECT REPORTS BY NATIONAL NAVAL DENTAL CENTER  
FIRST AND SECOND YEAR RESIDENTS - 1975-1976

by

G. B. PELLEU, JR.  
and  
R. W. GAUGLER



NATIONAL NAVAL DENTAL CENTER  
BETHESDA, MARYLAND 20014

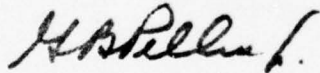
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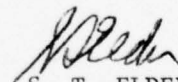
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Submitted by:



G. B. PELLEU, JR., Ph.D.  
Chairman, Research Department

Approved by:



S. T. ELDER  
Captain, Dental Corps, US Navy  
Commanding Officer

#### ABSTRACT

These abstracts provide a synopsis of research projects conducted by dental officers enrolled in the first- and second-year residency programs at the National Naval Dental Center, Bethesda, Maryland, during the academic year 1975-1976. The projects were completed in partial fulfillment of the requirements of the programs.

The opinions and assertions contained in these abstracts are the private ones of the writers and are not to be construed as official or as reflecting the views of the Department of the Navy.

Animals used in the studies were handled in accordance with the "Guide for the Care and Use of Laboratory Animals" prepared by the Committee on Revision of the Guide for Laboratory Animal Facilities and Care, of the Institute of Laboratory Animal Resources, National Research Council.

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## ABSTRACTS OF FIRST-YEAR REPORTS

### No. 1

#### AUTORADIOGRAPHIC EVALUATION OF LEAKAGE AROUND ENDODONTIC DOUBLE SEAL

J. G. Fleming and G. M. Taybos

Endodontic therapy requires that the root canal system be sealed from the oral environment between appointments. This is accomplished by the use of a temporary filling material. A double seal of gutta-percha and Cavit has become widely accepted as the method of choice. The purpose of this study was to evaluate, using the  $^{45}\text{Ca}$  autoradiographic technique, the sealing properties of the Cavit/gutta-percha double seal in extracted teeth for extended periods of time. A total of 87 teeth were used in this study. Clinically acceptable endodontic access preparations were made in the crowns. The canal orifices and pulp chamber floors were sealed with amalgam. Cotton pellets were placed in the pulp chambers followed by a layer of gutta-percha. The teeth were then divided into two groups. The first group of 44 teeth received an application of Copalite followed by a layer of Cavit. The second group of 43 teeth was sealed with Cavit alone. About 10 teeth from each of these groups were then immersed in saline solution at  $37^{\circ}\text{C}$  for 10, 30, 45, or 75 days, and alternately thermocycled about 500 times for 30 seconds at  $15^{\circ}\text{C}$  and  $60^{\circ}\text{C}$ . Following thermocycling, the teeth were prepared for autoradiography using the technique of Phillips. If the  $^{45}\text{Ca}$  encroached upon the pulp chamber on the X-ray, leakage was designated. All samples showed leakage of the  $^{45}\text{Ca}$  ion at each of the time intervals. No significant differences were noted with or without Copalite application, or when the leakage was compared at different time periods.

### No. 2

#### CAVITY PREPARATION FOR COMPOSITE RESIN: AN IN VITRO ASSESSMENT OF MICROLEAKAGE USING $^{45}\text{Ca}$

S. A. Fertig and M. T. Hanst

The acid-etch technique has been shown to improve mechanical retention and to reduce or eliminate marginal microleakage. Current studies show that an acid-etched featheredged restoration permits less microleakage than butt-joint restorations. However, a featheredged restoration cannot be restored to proper anatomical form. A beveled restoration can be finished to normal anatomical form. Acid-etched composite resin restorations with an approximately  $45^{\circ}$  beveled cavosurface margin and butt-joint-featheredged restorations were evaluated for microleakage. Selected specimens were also examined by scanning electron microscopy. The composite resin systems used were the Nuva System and the Concise Enamel Bond System. Class V cavity preparations were prepared in 40 extracted human teeth which were divided into groups according to marginal preparation, restorative material, and marginal finish. One-half of the teeth were subjected to thermocycling over a 14-day period. The remaining teeth were stored for 1 day in distilled water at  $37^{\circ}\text{C}$ . A radioisotope technique using  $^{45}\text{Ca}$



and autoradiographs was employed to assess microleakage. No differences in microleakage were noted between any groups. An important observation, supported by scanning electron micrographs, showed marginal breakdown in one-half of the butt-joint-featheredged restorations which had been subjected to thermocycling. These results indicate that the beveled cavity preparation can be finished to proper anatomical form and maintain resistance to marginal microleakage and fracture. On the basis of our findings, we concluded that the beveled cavity preparation is the procedure of choice for composite resin systems.

### No. 3

#### CELL-MEDIATED RESPONSE TO ENDODONTIC CEMENTS

A. D. Campbell and R. D. Gear

Root canal cements are known to cause inflammatory responses in periapical tissues, with infiltration of polymorphonuclear leukocytes, lymphocytes, macrophages, and plasma cells into the affected tissues. Lymphocytes are the cells responsible for specific immune responses. Antigens introduced into the root canals of primates can elicit systemic antibody formation. A root canal cement could conceivably act as an antigen or as an antigenic hapten-carrier complex and sensitize T-lymphocytes. Future usage of this root canal cement could activate the sensitized T-lymphocytes with a subsequent release of tissue-damaging lymphokines. The purpose of this study was to determine if endodontic cements are capable of eliciting a cell-mediated response in guinea pigs. Dilutions of 1:10, 1:20, and 1:30 of RC2B, Proco-sol, calcium hydroxide, and zinc oxide-eugenol were prepared by grinding the set cements to a powder and mixing them with Freund's incomplete adjuvant and saline solution. The adjuvant and saline solution alone served as a control.

The guinea pigs were injected with 0.1 ml of a respective cement suspension at each of the three dilutions and were observed at 24, 48, 72, and 96 hours, and at 1 week for the occurrence of an inflammatory response. All cement materials were found to elicit an inflammatory response in guinea pigs; however, after 1 week Proco-sol and calcium hydroxide showed significantly fewer responses at the 1:30 dilution than did RC2B or zinc oxide-eugenol. No relationship was established between these inflammatory responses and the presence of a delayed-type hypersensitivity response in this first stage, but the study is continuing in the next stage in an attempt to answer this question.

No. 4  
A CLINICAL EVALUATION OF FLUID RESINS FOR  
FABRICATION OF DENTURE BASES

J. T. Kennard

The autopolymerizing resins have been shown to exhibit a greater degree of processing accuracy than the heat-polymerizing resins. However, they have not received wide acceptance because of the varied clinical results obtained by different investigators. The purpose of this study was to compare three commercially available autopolymerizing resins for processing accuracy. The most accurate of these would then be further evaluated in a clinical environment. The autopolymerizing resin acrylics selected were Vernon Benshoff's Pronto, Dentsply's TruPour, and Coe's Pour-n-Cure. Six dentures were processed for each product. Identical casts were made from a master mold and were then used to make identical denture wax-ups from a second master mold. These dentures were indexed for three-dimensional measurement, and eight measurements were made for each denture at the National Bureau of Standards. The denture wax-ups were then processed according to the manufacturer's directions and measured again at 24 hours. Pronto demonstrated a total percentage change of  $0.36\% \pm 0.27\%$  with seven of the eight measurements showing shrinkage. TruPour gave a total percentage change of  $0.40\% \pm 0.53\%$ , with three of the eight values showing shrinkage. Pour-n-Cure gave a total percentage change of  $4.1\% \pm 4.2\%$ , with six of the eight values showing shrinkage. The direction of processing error varied for each product. The movement for Pronto is generally in one direction, which reflects uniform shrinkage. The error for Pour-n-Cure and TruPour is almost equally divided between expansion and shrinkage. Since the Pronto showed the smallest percentage change and lowest standard deviation, it was selected as the material of choice for continuation of this study.

No. 5  
DETECTION OF SURFACE CHARGES ON ENAMEL

T. P. Barton and Ralph E. Schnee

Bacteria are known to be etiologic agents of dental caries and periodontal disease. However, the mechanism for the initial attraction of bacteria to the enamel surface is unknown. Since several species of oral bacteria are known to possess electrical charges, it is possible that the enamel of tooth surfaces possesses an opposite charge that would attract disease-producing bacteria to these sites.

The purpose of this study was to evaluate both facial and lingual enamel surfaces for the presence of electrical charges using an isoelectric focusing column technique. A total of six facial and four lingual enamel surfaces from lower right third molars were pulverized with a



pestle in a mortar and then repulverized with a stainless steel capsule and pestle for three 30-second intervals. A total of 100 mg of each enamel sample was added to the isoelectric column according to the manufacturer's instructions. After focusing for 48 hours, a pH gradient of 3.5 to 10 was produced in the column, which was then separated into 3.25 ml fractions and examined spectrophotometrically. The pH and optical density of each fraction were measured at 660 nm for enamel turbidity and 280 nm for proteins. Control values were subtracted from experimental values and plotted against pH. One lingual and two facial plottings showed optical density peaks at pH 4.5 indicating a negative charge; whereas the 280 nm (protein) plot showed an optical density plateau from pH 6.7 to 9.4 indicating a positive charge. Thus, the facial surface was found to be negatively charged and the lingual both positively and negatively charged.

No. 6  
THE EFFECT OF BURNISHING ON MICROLEAKAGE  
OF THE AMALGAM SYSTEM

E. F. Eschete and T. G. Cothren

In recent years burnishing of an amalgam alloy has been advocated as a routine clinical procedure by several investigators, but the question of leakage in relation to burnishing and use of cavity varnish remains unanswered. The purpose of this study was to determine the effects of burnishing and using cavity varnish on microleakage of a commonly used alloy. A group of 50 teeth was burnished once after carving. A second group of 50 teeth was burnished once after condensation and again after carving. A third group of 70 teeth was not burnished, but served as the control. Copalite was applied to 25 teeth in each of the first two groups, and to 40 teeth in the control group. All specimens were thermocycled through a 30° C temperature differential every 30 seconds for 1 hour. They were then prepared for evaluation of leakage using the autoradiographic technique described by Phillips and others. Leakage was defined as penetration of the  $^{45}\text{Ca}$  ion along a cavity wall. The results showed no significant difference between the burnished and nonburnished specimens. However, comparisons made between the specimens with and without copal varnish use, show significant reductions in microleakage for all techniques utilizing copal varnish. It was concluded that burnishing has no effect on microleakage when using Optaloy, but leakage can be reduced by a copal varnish.

No. 7

THE EFFECT OF VARIOUS CLASPING SYSTEMS USED FOR DISTAL EXTENSION  
REMOVABLE PARTIAL DENTURES ON THE MOBILITY OF ABUTMENT TEETH

R. M. Rohen and O. C. Tebrock

Distal extension removable partial dentures have long been implicated in the increase in mobility and destruction of the supporting structures of the primary abutment teeth. The purpose of this study was to clinically evaluate the degree of tooth mobility produced by three clasp systems. The first is a cast circumferential retentive arm with distal rest and adequate lingual bracing. The second is an 18-gauge wrought wire retentive arm, distal rest, and adequate lingual bracing. The third is an I-bar cast infrabulge retentive arm, mesial rest, distal guide plane, and adequate lingual bracing. Patients selected for study require treatment with a mandibular removable partial denture. Mobility measurements were made with a periodontometer at weekly intervals for at least 1 month to establish an abutment tooth mobility for each patient. Following establishment of the mobility baseline, the first of the three removable partial denture clasp designs was inserted. Abutment tooth mobility was checked at weekly intervals for 1 month. Following 1 month of insertion, the first removable partial denture was removed and the abutment tooth was allowed to return to its original baseline mobility. The second and third removable partial denture clasp designs were inserted and removed following the same sequence. Preliminary results tend to reveal an increase in abutment tooth mobility for all clasp designs. Analysis of data from this study could indicate which clasp system produces no increase or the least increase in mobility of abutment teeth in distal extension removable partial dentures.

No. 8

THE EFFICACY OF GLUTARALDEHYDE IN THE DECONTAMINATION OF  
ROOT CANALS IN EXTRACTED TEETH

E. J. Grant

A problem associated with endodontic therapy is the toxicity of currently used intracanal medicaments to periapical tissues. A 2% alkaline glutaraldehyde solution (Cidex) has been shown to have only slight to moderate toxicity and is one of the few disinfectants classified by the Environmental Protection Agency as a sterilizing agent. This study investigated the efficacy of glutaraldehyde solution as an antimicrobial agent in extracted teeth. Single-rooted extracted teeth were endodontically prepared, and the roots were sealed with clear nail varnish and sticky wax. The teeth were sterilized with gaseous ethylene oxide and inoculated with approximately  $10^7$  colony-forming units of *Streptococcus fecalis*. Glutaraldehyde was then directly transferred to the root canal in measured

amounts of about 0.01 ml. In an attempt to increase the probability of contact between medicament and the inoculum within the root canal, the medicament was also introduced into the canal by direct transfer, but followed by a 30-second agitation with a barbed broach, and by indirect transfer via a sterile paper point. The teeth were incubated at 37° C for 15-, 30-, and 60-minute exposure times. The teeth were crushed in a grinding device (Micro-mill) with 10 ml sterile saline solution and assayed for the number of recoverable colony-forming units. The number of colony-forming units recovered in the test teeth were compared with those recovered in the teeth where no medicament was used. The results were tabulated as mean microbial reductions for each technique.

Microbial reductions of about 99.9%, or 100-fold, were generally found for the test teeth. A reduction of 99.99%, or 1000-fold, was noted, however, for test teeth agitated with a broach following the 60-minute exposure. This indicates a slightly improved contact between medicament and inoculum. It is concluded that a 2% alkaline glutaraldehyde solution is highly effective in reducing large concentrations of a resistant streptococcus in extracted teeth.

#### No. 9

### AN EVALUATION OF ENDODONTIC STAINLESS STEEL BOXES FOR MAINTAINING STERILITY OF INSTRUMENTS AND MATERIALS

L. F. Hellman and T. L. Silverthorn

Endodontists generally agree that treatment should be administered in an aseptic manner to minimize the possibility of cross-infection and of bacteremia. Although stainless steel boxes are commonly used to sterilize and store endodontic instruments, there is a lack of information about the ability of these boxes to maintain sterility within them. In this study the rate of contamination of the contents of these boxes was clinically evaluated. While monitoring the microbial air contamination levels of an 18-chair dental clinic, four previously sterilized boxes containing a random arrangement of files were either opened intermittently or were left open for exposure times of 10 to 60 minutes. The cumulative effect of prolonged 30-day exposures on file contamination was also determined. The files were tested for contamination by culturing them in trypticase soy broth (BBL). At microbial contamination levels in the air of about 6 VP/ft<sup>3</sup>, instrument contamination did not differ significantly within boxes opened intermittently from that in boxes left open continuously. Once a box was contaminated, there was no apparent accumulation of contaminated files after 30 days of exposure. It was concluded that after the files have been exposed for 10 minutes, the boxes should be resterilized by the original method or the individual files resterilized clinically with chairside methods.



No. 10  
INSTRUMENT STERILIZATION USING ETHYLENE OXIDE GAS IN A  
PORTABLE STERILIZING CYLINDER

J. E. Bosley and C. J. Coleman

There is a need in dentistry for a rapid, inexpensive, practical, and efficient method of sterilizing instruments and materials that cannot be sterilized at high temperatures by conventional means. Most promising is an airtight portable aluminum cylinder using gaseous ethylene oxide which was developed and tested at the National Naval Dental Center; further investigation is indicated for a thorough quantitative evaluation. The purpose of this study was to determine the minimum amount of ethylene oxide mixture (Cry-Oxide) required in this procedure to sterilize artificially contaminated handpiece contra-angles. Contra-angles artificially contaminated with about 10 million *Bacillus subtilis* spores diluted in either acetone or acetone/serum solution (50%) were placed in the cylinders along with a measured quantity of ethylene oxide mixture, ranging from 0.1 to 1.0 grams. After the sealed cylinders were boiled in water for 15 minutes, the instruments were removed and assayed for positive cultures for the number of colony-forming units recovered. The results showed that the acetone-spore contaminated instruments were sterilized with a minimum of 0.4 gram ethylene oxide mixture; whereas the serum-spore contaminated instruments required a minimum of 1.0 gram. We believe that this method offers several advantages and should be considered for sterilization of dental instruments and materials not amenable to conventional means of sterilization.

No. 11  
AN INVESTIGATION OF A MARGIN SEALER FOR LEAKAGE  
IN AMALGAM RESTORATIONS

J. D. Arnold and L. R. Escude, Jr.

Most investigators and clinicians agree that secondary caries in amalgam restorations initially begins with marginal separation of a restorative material from the cavity wall. The concept of an externally applied margin sealer for amalgam restorations holds promise, since theoretically the sealer could be applied to deteriorating amalgam margins and help prevent secondary caries in the same manner that pit and fissure sealants are presently applied to virgin teeth as an aid in the prevention of primary caries. The purpose of this study was to investigate the sealing capabilities of Silverseal in extracted posterior teeth using autoradiographic techniques to determine microleakage. A sample size of 29 posterior teeth with deteriorating amalgam restorations was examined in this study. Ten of the twenty-nine teeth were treated with an acid cleanser solution prior to the application of Silverseal, and nine teeth were treated with Silverseal alone, omitting the optional

acid cleanser step. Neither acid cleanser nor Silverseal was applied to the 10 teeth that were controls. The teeth were alternately thermocycled 500 times at 15° C and 45° C for 30 seconds and evaluated for leakage of the radioisotope solution. Silverseal was not found to be effective in preventing leakage. Nine out of ten (90%) of the teeth treated with acid cleanser and Silverseal showed leakage. In the second sample where the acid cleanser was omitted and the teeth were treated with Silverseal alone, 100% of the teeth leaked.

No. 12

THE PHYSICAL PROPERTIES OF REPEATEDLY USED NONPRECIOUS METAL  
ALLOYS IN FIXED PARTIAL DENTURE CASTINGS

D. A. Hesby and P. Kobes

Nonprecious metal alloys are often substituted for precious metal alloys in the fabrication of fixed partial dentures. Since the cost of nonprecious metals has increased, it would be economically advisable to reuse them in combination with new nonprecious metal as is currently done with precious metal alloys. However, the desired physical properties of an alloy should be maintained above minimum ADA specifications; otherwise, clinical failure of fixed partial dentures would result. The purpose of this study was to determine if the physical properties were altered below minimum ADA specifications after repeated melting. A total of ten castings for each of three generations will be made and tested for the physical properties of tensile strength, percent elongation, yield strength, Rockwell hardness, and modulus of elasticity. Following this comparison, ten castings using combinations of 2/3 new metal, 1/4 new metal, and 1/3 new metal added to second generation castings will be made and tested for these physical properties. Preliminary findings of only two samples of first and second generation castings resulted in a tensile strength below the minimum ADA specification of 6,300 kg/cm<sup>2</sup>. The Rockwell hardness findings were within the minimum ADA specifications. The percent elongation was well above the minimum of 1.5%, which may explain why the tensile strength values were below the minimum standards. Further samples are being tested in this study to determine the validity of these findings.

No. 13

SCREW-TYPE PLASTIC CAPSULES EVALUATED FOR MERCURY  
LEAKAGE DURING TRITURATION

R. W. Scott and T. P. Barton

The purpose of this study was to evaluate the durability of screw-type plastic capsules used in trituration procedures by monitoring for mercury leakage. A total of 12 new screw-type capsules and 6 new friction-type capsules with their respective pestles were tested in this study.



All capsules were triturated for 20 seconds in a low speed amalgamator using two pellets of alloy and two drops of mercury. To determine leakage, a mercury vapor sniffer (Bachrach) was utilized to detect mercury vapor in the air during trituration. Mercury vapor readings were also determined for both screw- and friction-type capsules during trituration without the addition of alloy and mercury (controls). After 150 triturations per capsule, which would be equivalent to about 30 days' clinical use, there was no apparent loss of mercury from either the screw- or the friction-type capsules. Readings made during the first 80 triturations with an old amalgamator showed mean vapor readings of  $0.011 \pm 0.16$  mg Hg/m<sup>3</sup> for the screw-type capsules and  $0.008 \pm 0.01$  mg Hg/m<sup>3</sup> for the friction-type capsules. Readings made for the second 70 triturations with a new amalgamator were  $0.003 \pm 0.006$  and  $0.000 \pm 0.008$ , respectively. Comparisons between the first and second groups of triturations were significant. The mechanical amalgamator was believed to be the major contributor to these vapor levels, apparently for both types of capsules by its retention of macroscopic droplets of mercury. At no time in the study did the mercury vapor readings approach the threshold limit value (TLV) of 0.05 mg Hg/m<sup>3</sup>.

No. 14  
A STUDY OF GAP FORMATION IN TEETH  
RESTORED WITH COMPOSITE RESINS

F. U. Perry and L. V. Kuhl

Several clinical investigators have reported marginal staining associated with composite resin restorations. A gap at the tooth-material interface, or in the enamel near the tooth-material interface, appears to be the reason for this staining. A study was conducted to evaluate gap formation at or near the tooth-material interface in relation to the bis-GMA content of three composite resin restorative materials. Class V cavities were prepared in recently extracted third molars with a No. 330 high-speed bur and were restored with Concise, Cap-C-Rynge, and Prestige. One-half of the preparations were subjected to an acid-etch technique prior to placing the restoration. Results showed that Prestige produced a significantly larger number of gaps than did Concise when the restorations were compared following the nonacid-etch technique, and also produced a significantly larger number of gaps than both Concise and Cap-C-Rynge using either technique. There was an apparent trend toward both larger gaps and a higher total gap percent as the percent composition of bis-GMA decreased in the material. Observations from preliminary testing of cavity preparations finished with four different burs were that enamel separation cracks were frequent. This finding for both unrestored and restored teeth suggests that cavity preparation procedures produce enamel defects prior to the placement of restorative materials.

THE USE OF ASCORBIC ACID BIOFLAVONOIDS IN THE TREATMENT OF  
EXTRAORAL HERPETIFORM LESIONS

G. T. Terezhalmay

A water-soluble bioflavonoid-ascorbic acid complex has been used with success to repress capillary permeability and fragility in some viral infections; however, no studies have been reported on its effect in viral herpetiform lesions. The purpose of this study was to clinically evaluate the efficacy of water-soluble bioflavonoid-ascorbic acid complex in minimizing the clinical signs and symptoms associated with capillary changes in herpes labialis infections.

A total of 25 episodes of recurrent herpes simplex virus infections were evaluated in this study. Treatment consisted of administering either a complex of 1,000 mg of water-soluble bioflavonoids and 1,000 mg of ascorbic acid, or a lactose placebo, by a double-blind technique. The therapeutic dosage was administered in five equal daily increments for 3 days after the appearance of initial symptoms. All evaluations were completed before the code was broken.

The therapeutic measure was found to be effective when instituted in the early prodromal stage of the disease process. It was observed to reduce vesiculation and to prevent disruption of the vesicular membrane. Complete remission of the symptoms was obtained in  $4.2 \pm 2.2$  days in all cases where treatment was initiated when the premonitory symptoms were recognized. No adverse reactions were reported by any of the patients under treatment.

The results presented in this report are preliminary; the study is continuing in an effort to collect enough data for greater validity.

## ABSTRACTS OF SECOND-YEAR REPORTS

### No. 1

#### CLINICAL EVALUATION OF FREEZE-DRIED BONE ALLOGRAFTS IN PERIODONTAL OSSEOUS DEFECTS. PART II.

W. W. Sepe

Data published previously indicated that the freeze-dried crushed cortical bone allograft has potential as a grafting material in certain human periodontal osseous defects. This report supplies additional data and information that reinforces the conclusion drawn in that publication. Also included are other clinical data not previously presented. Data from military and civilian periodontists were evaluated for bony regeneration and pocket elimination in patients treated with freeze-dried allografts in 1-wall, 2-wall, widemouthed 3-wall, combination, and furcation defects. Therapy was planned as a two-stage procedure, with a 1-year reentry to allow for direct verification of any osseous regeneration. Bony regeneration as well as pocket elimination was recorded as complete; greater or less than 50%; or failure. A total of 189 graft sites have been reentered in 97 patients. In 42 additional sites (12 patients), documentation was sufficient without reentry for inclusion in pocket elimination figures. Thus, 231 grafts were evaluated in 109 patients. Freeze-dried crushed cortical bone allografts demonstrated greater than 50% osseous regeneration in 60% of all treated defects. Pocket reduction was greater than 50% in 63% of all defects treated. The additional evidence presented in this report indicates that freeze-dried bone allografts have definite potential as grafting material in certain periodontal osseous defects.

### No. 2

#### A CLINICAL EVALUATION OF THE PERIODONTIUM OF RENAL TRANSPLANT PATIENTS UNDERGOING IMMUNOSUPPRESSIVE THERAPY

J. N. Hamilton and L. D. Coleman

The cellular immune system has been implicated in the pathogenesis of periodontal disease. This investigation was undertaken to evaluate changes in the periodontal status of renal transplant patients before and during suppression of their cellular immune system. An attempt was made to establish a relationship between these findings and the cellular immunocompetence of each patient. The periodontal status of five patients was evaluated using gingival and plaque indices, pocket charting, and radiographs. The immunocompetence of each patient was determined using tests in which mixed lymphocyte cultures were stimulated with the mitogen phytohemagglutinin. The degree of cellular immunocompetence among patients varied, but was suppressed in all patients with immunosuppression. The ratio of gingival index to plaque index (GI/PI) was low before transplant and for 6 months post-transplant, but later increased. There was no relationship between GI/PI ratio and either immunocompetence or PI. No changes were noted in radiographic appearance. Because of the small patient sample and variability in results, no conclusions can be made. Further investigations are indicated.



No. 3

THE EFFECT OF VACUUM-PRESSURE CASTING TECHNIQUES ON MARGINAL  
ADAPTATION OF BASE METAL ALLOYS

R. C. Wisser and R. B. Carlson

Because of the recent increases in the cost of gold, many non-precious or base metal alloys have been introduced to the dental profession. It is possible that the low specific gravity of base metal alloys and the lack of sufficient casting pressure may be related to the difficulties encountered in accurately casting these alloys. The purpose of this study was to evaluate the effect of a vacuum-pressure casting technique on the marginal fit of a base metal (Ticon) casting compared with that of a precious metal alloy (Jelenko "O") casting. Five gold and ten Ticon extracoronary castings were made on standard ADA steel dies; 5 gold and 15 Ticon intracoronary castings were made on a modified MOD die. All of the castings were made using a Whip-Mix Tricaster vacuum-pressure casting machine. Five different methods of spruing the intracoronary castings were also evaluated. Investing of all patterns was in accordance with manufacturer's directions. The gold was melted with a gas and oxygen torch; the Ticon was melted with an acetylene and oxygen torch. Marginal openings were measured for each extracoronary casting at 10 predetermined points marked on the circumference of the steel dies after removal of internal discrepancies. The mean marginal opening, in microns, for Jelenko "O" was  $16.6 \pm 3.4$ , and for Ticon it was  $17.1 \pm 3.4$ . No significant difference was found when comparing the results with Student's  $t$  test. The intracoronary castings of gold and Ticon could not be cast within clinically acceptable limits. It was also apparent that sprue design was more critical for the Ticon than for the gold.

No. 4

PROCION LABELING OF OSTEOGENESIS IN RATS FOLLOWING CALCIUM  
HYDROXIDE IMPLANTATIONS IN MAXILLARY ALVEOLAR BONE WOUNDS

W. T. Cunningham and J. L. Frazier

Several currently used endodontic techniques involve the placement of calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) pastes within the root canal system. Few studies have been undertaken to determine the effect these pastes might have when inadvertently extruded into the periapical tissue. The purpose of this study was to determine histologically the effect of  $\text{Ca}(\text{OH})_2$  in mechanically induced rat alveolar bone wounds utilizing Procion dye to label areas of osteogenesis. A total of three surgical defects were created in the maxillary bone of each of nine Sprague-Dawley rats. One defect was used as a control, one was filled with  $\text{Ca}(\text{OH})_2$  and camphorated paramonochlorophenol (CMCP), and the other was filled with  $\text{Ca}(\text{OH})_2$  and water. Four of the nine surgically treated rats were injected with

Procion dye to label areas of osteogenesis. The animals were sacrificed at intervals of 10, 17, 24, 31, and 38 days and were examined histologically by light and fluorescent microscopy. All defects were observed to show only a minimal inflammatory response. When compared with the control sites,  $\text{Ca(OH)}_2$  with water was found to have a more rapid rate of new bone formation, while  $\text{Ca(OH)}_2$  with CMCP showed a similar or decreased rate of bone repair. Procion dye was found to accurately label the extent of new bone formation. New bone formation was noted to extend along the periodontal ligament at the  $\text{Ca(OH)}_2$  sites in the 17-, 24-, and 31-day specimens. This finding did not occur with any of the control lesions.

No. 5

RADIOGRAPHIC INTERPRETATION OF EXPERIMENTALLY PRODUCED  
OSSEOUS LESIONS OF THE HUMAN MANDIBLE

A. K. LeQuire

Periapical pathosis with bone destruction can exist without being apparent on radiographs. This study was undertaken to evaluate the effect of the long-cone technique and recommended developing times on the radiographic appearance of experimentally produced defects in cancellous bone. Ten dry human mandibles were used. One group of four were studied dry. Another group of six were studied dry with a water phantom to simulate soft tissue absorption. The radiographs of the latter group were interpreted by five dentists in a blind study. The teeth were removed and the mandibles were sectioned mesiodistally. Artificial lesions were produced by removing cancellous bone from around the apices of the roots of 24 premolars and 29 molars by means of a No. 4 dental bur. The size of these lesions varied from approximately 1.5 to 4.5 mm. With the teeth in their alveoli and sections in approximation, radiographs were taken presectioning, postsectioning, and after the lesion was produced. Radiographs were made with a mounting apparatus which standardized angulation and distance. Extended-cone technique was utilized at settings of 15 mA and 90 kVp at 7/10 and 8/10 second. The findings indicate that radiographs should be produced by the extended-cone technique and processed in accordance with recommended times. Of the 68 lesions produced, 26 were graded completely visible radiographically, 18 moderately visible, 13 slightly visible (but only on comparison with the original condition), and 11 not visible. There was no statistical significance in the addition of soft tissue absorption as related to lesion visibility.



No. 6

A STUDY OF THE WEAR OF NONPRECIOUS METALS ON ENAMEL SURFACES

W. T. Coggeshall and R. C. Melendez

Current trends in dentistry toward nonprecious alloys have revealed the limited available data regarding the handling properties and characteristics of these new alloys. The purpose of this study was to first develop a machine capable of giving reproducible wear that could be correlated with the oral environment and then to evaluate the wear characteristics of nonprecious alloys against enamel.

Ticon, Cameo, and Type 3 gold alloys were evaluated with a machine developed by us that produced a constant slide between a stationary enamel specimen and a rotating metal disk. A constant load and slide distance were used to compare the amount of wear for the enamel-metal combination. The scanning electron microscope was used to evaluate the surfaces of the specimens.

The mean wear rate for metal-enamel combinations was  $13.610 \pm 7.204 \times 10^{-3} \text{ mm}^3$  for Ticon,  $10.198 \pm 6.567 \times 10^{-3} \text{ mm}^3$  for Cameo, and  $5.321 \pm 3.412 \times 10^{-3} \text{ mm}^3$  for Type 3 gold. The differences between Ticon and Cameo when compared with Type 3 gold were significant according to Student's  $t$  test ( $P < .01$ ). Abrasive, adhesive, and delamination mechanisms of wear were suggested by the photomicrographs.

No. 7

VARIABLES AFFECTING THE STRENGTH OF THE PORCELAIN/NONPRECIOUS ALLOY BOND

T. A. Wight

The strength of the bond between porcelain and nonnoble or base metal alloys may be affected by slight variations in laboratory procedures. The bond is adversely affected when imperfections in the metal surface may result in inclusions of gas in the porcelain veneer on subsequent firings under vacuum. A variety of materials is used in the fabrication of casting patterns. The purpose of this study was to investigate the effect of using different investments in combination with different pattern materials on the castability of a base metal alloy (Ticon). A total of 200 test tabs were cast in rings of 40 tabs each by a special spruing technique. Eighty test tab patterns were made from a combination of methyl methacrylate and vinyl, and 120 test tab patterns were fabricated entirely from methyl methacrylate. Ceramigold and Ticovest were the two investments used in the study. Induction heating using slow controlled heat rate settings was used to cast all specimens. They were examined grossly and with the scanning electron microscope for

surface quality. Pronounced surface defects were noted on all pattern surfaces of the Ticovest investment where vinyl was used, regardless of whether the vinyl was located in the interface surface or in the body of the tab. Although the situation was somewhat less dramatic with Ceramigold investment, the defects continued to appear wherever vinyl was used in the pattern. The test tab surfaces fabricated entirely from methyl methacrylate were without surface defects, regardless of the investment.

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